REMARKS

In the Office Action of January 2, 2009, claims 1-2 were objected to because of the informalities.

In response to the objection, claims 1 and 2 have been amended to obviate the objection.

On page 3 of the Action, claim 2 was rejected under 35 U.S.C. 112, second paragraph. In this respect, claim 2 has been amended to particularly point out and distinctly claim the subject matter of the invention.

On page 4 of the Action, claims 1 and 2 were provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-2 of copending Application No. 11/988,033.

In response to the double patenting rejection, the terminal disclaimer will be filed when the copending application No. 11/988,033 is ready to be allowed except for the double patenting rejection.

On page 5 of the Action, claims 1 and 2 were rejected under 35 U.S.C. 102(f). The article submitted in the IDS entitled "Direct-bandgap properties and evidence for ultraviolet lasting of hexagonal boron nitride single crystal" was made by Kenji Watanabe, Takashi Taniguchi, and Hisano Kanda, wherein Hisano Kanda only discloses evaluation of optical properties. Here, claims 1 and 2 elected in response to the restriction requirement of October 28, 2008 were made by Kenji Watanabe and Takashi Taniguchi. Therefore, a request to correct inventorship is filed with the fee set forth in §1.17(i) to delete other five inventors.

On page 6 of the Action, claims 1-2 were rejected under 35 U.S.C. 102(a) as being anticipated by "Direct-bandgap properties and evidence for ultraviolet lasting of hexagonal boron nitride single crystal" authored by Watanabe et al.

In this regard, claims 1 and 2 were invented and disclosed in Japanese Patent Application No. 2003-388467, prior to June, 2004 of the above publication. A verified translation of a Japanese priority document No. 2003-388467, filed on November 18, 2003, will be filed in a timely manner to obviate the rejection.

On page 8 of the Action, claims 1 and 2 were rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Bundy et al. (US 3,212,851).

In response to the rejections, claims 1 and 2 have been amended to further clarify the feature of the invention. Claims 16-18 have been newly added. Claims 3-15 have been canceled.

Specifically, claim 1 has been amended to call for the highly pure hexagonal boron nitride single crystals (hereinafter hBN) to <u>emit far ultraviolet light having a maximum light emission peak in a far ultraviolet region at a wavelength of 235 nm or shorter (hereinafter "feature (A)")</u> and <u>have a hexagonal prism form with millimeter size (hereinafter "feature (B)")</u>.

If the highly pure hBN single crystals according to the present invention are used, due to the feature (A), short wavelength far ultraviolet laser emission is possible at a wavelength shorter than that of a conventional one. In addition, due to the feature (B), the highly pure hBN single crystals of the present invention obtain far ultraviolet light emission with sufficient luminance for practical use, and are easily processed and designed for a solid-state laser and emitting apparatus. Thus, the highly pure hBN single crystals of the present invention can provide an effect, for example, for making the photolithography high miniaturization in the field of semiconductors; making high-density recording media in the field of the information; and powerful sterilization and the like due to high power output (see page 14, lines 11 to page 15, line 5, and page 39, line 14 to page 40, line 1 of the specification in the present application).

Specifically, objects of the present invention are to: focus on the hBN wherein no disclosure has been made with respect to presence or absence of light emission in the far ultraviolet region; explore possibilities for the hBN as solid-state light emitting materials; and apply the hBN to the solid-state light emitting materials (see page 3, lines 11-23 in the specification). In order to achieve the above-mentioned objects, the inventors of this application have successfully discovered that the highly-purified hBN has the feature (A) "emitting far ultraviolet light having the maximum light emission peak in the far ultraviolet region at a wavelength of 235 nm or shorter".

Moreover, as opposed to a conventional hBN which is utilized in the form of powder and sintered body, the inventors of this application have made the highly-purified hBN single crystals as bulk single crystals with the feature (B). As a result, the far ultraviolet light emission with the feature (A) has been improved. Accordingly, the inventors of this application have succeeded in obtaining the highly-purified hBN single crystals which can be used as ultraviolet light emission materials with sufficient luminance for practical use (see page 7, line 25 to page 8, line 26; page 19, lines 10 to 23, page 21, line 11 to page 22, line 1; page 23, lines 8 to 13; page 24, lines 2 to 6; page 25, lines 8 to 10; page 26, line 17 to page 27, line 3 of this application). Also, the inventors of this application have successfully developed the solid-state far ultraviolet laser, far ultraviolet light emitting apparatus and the like by performing vapor deposition to the bulk single crystals which were processed into a parallel plate formed by delamination; processed into the shape of rectangular waveguide; and further processed with the above-mentioned processes by utilizing the bulk single crystals with the feature (B).

Thus, the highly pure hBN single crystals according to claim 1 of the present invention include both the far ultraviolet light

emission feature with the sufficient luminance for practical use and the capability of being easily processed which is essential for applying to various usages. Accordingly, the highly pure hBN single crystals according to claim 1 of the present invention have a novelty and utility.

Also, as recited in currently amended claim 18, due to a recrystallization process using a solvent (boronitride of alkali earth metal, or boronitride of alkali earth metal and boronitride of alkali metal) without oxygen impurities, and boron nitride, higher purified hBN single crystals are obtained. Therefore, the hBN single crystals having the above-mentioned features (A) and (B) can be reliably obtained.

Bundy (US 3,212,851) relates to boron nitride (hereinafter referred to as wBN) including a wurtzite structure, more specifically, to obtain the wBN by using the hBN that the Examiner has pointed out as a well-known art, as sample materials, and by subjecting the hBN to high temperature and high pressure, and the features thereof. Bundy has discovered the wBN which differs from the hBN by subjecting the hBN to temperature and pressure in an upper region than a line shown by WH in Fig. 7. Also, the wBN obtained by the above-mentioned method is polycrystalline containing a number of small crystals (see paragraph 6, lines 19 to 20 in Bundy).

Also, Bundy utilizes a solid molded form of hBN containing 97.5% (containing 2.45% of B_2O_3) and hBN containing 99.8% (containing 0.2% of impurities) as the hBN used for the sample materials (see paragraph 6, lines 4, 6, 38 to 40 and 42 in Bundy).

As to differences between wBN in Bundy and hBN in the present invention, as described in the above, the wBN according to Bundy can be obtained by subjecting the hBN of the sample materials to the temperature and pressure of the upper region than the line shown by the WH in Fig. 7 of Bundy, and has the wurtzite structure

which is a stable structure in the region thereof (for example, see claim 1 of Bundy).

However, on the other hand, in the present invention, the highly pure hBN single crystals can be obtained by subjecting the temperature and pressure of the region shown as hatching in Fig. 1 (Note that Fig. 1 in the present invention corresponds to Fig. 7 in Bundy). The highly pure hBN single crystals of the present invention have a hexagonal structure which is a stable structure in the region thereof.

Therefore, since the crystal structure of the highly pure hBN single crystals according to claim 1 of the present invention differs from the crystal structure of the wBN of Bundy, the highly pure hBN single crystals according to claim 1 of the present invention is significantly different from the wBN of Bundy. Needless to say, the wBN of Bundy having the different structure would never have the above-mentioned feature (A) according to claim 1.

Also, the wBN of Bundy is the polycrystalline containing a number of small crystals. Bundy does not disclose or suggest the sufficient luminance for practical use and the capability of being easily processed to the solid-state laser and the like by making the bulk single crystals such as the above-mentioned feature (B).

As a result, the highly pure hBN single crystals according to claim 1 of the present invention is significantly different from the wBN of Bundy.

As to the differences between the hBN of Bundy and highly pure hBN single crystals of the present invention, Bundy discloses the use of the conventional hBN as the sample materials. As mentioned above, the conventional hBN of Bundy is not highly purified, which contains the impurities such as 97.5% pure hBN (containing 2.45% of B_2O_3), 99.8% pure hBN (containing 0.2% of the impurities) and the like. Furthermore, it is the solid molded form.

Therefore, it can be said that such conventional hBNs contain the impurities in a similar fashion with such as, for example, the commercially available hBN sintered body and hBN powder described in page 25, line 23 to page 26, line 2 of the present application, so that it differs from the highly pure hBN single crystals according to claim 1 of the present invention. This is obvious from the Comparative Example 1 (see page 25, line 23 to page 26, line 2 of this application), the commercially available hBN sintered body and hBN powder do not have the feature (A). Therefore, the hBN of Bundy is <u>not</u> highly purified, and does <u>not</u> have the feature (A), unlike claim 1 of the present invention.

Also, since the hBN of Bundy is the solid molded form, it does not have the feature (B) according to claim 1. Naturally, it is impossible that the hBN of Bundy shows the feature (A) such as the sufficient luminance for practical use.

Moreover, Bundy does not suggest about utilizing the hBN containing the impurities as the solid-state light emitting materials for the solid-state laser and the emitting apparatus. Naturally, Bundy does not disclose or suggest the high purification of the hBN as shown in the feature (A) with respect to the conventional hBN. Also, Bundy does not suggest about the conversion of the conventional hBN so as to the feature (B) for the solid-state laser, the emitting apparatus, and obtaining the sufficient luminance for practical use.

Therefore, the highly pure hBN single crystals according to claim 1 are significantly different from the hBN of Bundy.

On the grounds stated above, claim 1 and all dependent claims depending from claim 1 of the present invention are not anticipated by, or obvious from Bundy.

The Examiner stated that the feature (A) is a unique feature of the hBN and that it would be obvious to one having ordinary skill in the art at the time of the present invention to recognize

the highly pure hBN single crystals of the present invention as most likely an inherent characteristic of single crystalline material.

The applicant respectfully traverses this opinion on ground as follows.

A light emission spectrum of crystals changes depending on the quality of the crystals which determines a relaxation process from an excited state of the crystals, i.e., the relaxation process. Specifically, the light emission spectrum of the crystals is relaxed in an impurity defect level of the crystals from the excited state according to impurity defect inside the crystals. According to the quality of the crystals, various relaxation processes are possible such as the relaxation process of transiting to the ground state due to a radiation transition with light emission or non-radiation transition without light emission; the relaxation process of transiting to the direct ground state due to the radiation transition from the excited state such as the hBN of the present invention which is highly purified and does not have an impurity defect level, and the like. <u>Thus, even if the crystals might appear to be the same, light emission feature significantly changes according to the quality of the crystals.</u> This strongly suggests that the light emission feature in the crystals is not definite feature of the crystals, but they are highly variable based on the quality of the crystals.

Also, after filing of the present invention, the inventors have conducted further studies regarding the hBN, and have found that only the hBN single crystals which are highly purified have the above-mentioned feature (A), and that if the hBN single crystals have the above-mentioned feature (B), they can obtain the sufficient high luminance for practical use (Reference 1: T. Taniguchi, and K. Watanabe, journal of Crystal Growth 303, 525-529). Moreover, the inventors of the present invention have

clarified that the highly pure hBN single crystals of the present invention having the features (A) and (B) is transparent because they do not have impurity defect absorption in a visible range (see IDS documents cited by the Examiner). The light emission spectrum of the conventional hBN of the solid molded form which contains the impurities and is not the bulk single crystals such as the inventions by Bundy and the like, has the light emission spectrum as shown in Fig. 6 of the Reference 1 according to a degree of a impurity density, and does <u>not</u> have the maximum light emission peak in the far ultraviolet region at a wavelength of 235 nm or shorter, and the impurity defect light emission is more likely to be dominant <u>in the longer wavelength range from 235 nm to 300 nm</u>.

Therefore, the Examiner's notion that the feature (A) is a inherent feature of the hBN and it would be obvious to one having ordinary skill in the art at the time of the present invention to recognize the highly pure hBN single crystals according to claim 1 as most likely an inherent characteristic of single crystalline material is incorrect.

Moreover, in order to apply the highly pure hBN with the feature (A) to the solid-state laser and the emitting apparatus and the like, the highly pure hBN is required to have the light emission with sufficient luminance for practical use, and applicability to the solid-state laser, emitting apparatus and the like. For those purposes, even though it is well-known that the form of the conventional hBN is powder and sintered body, the inventors of the present invention have focused on the single crystals as a completely new form, and found out that it is essential to be the bulk single crystals such as the feature (B). Namely, the highly pure hBN single crystals of the present invention are the bulk single crystals having the feature (B) which have a completely different form from that of the conventional hBN, so that the present invention achieves the above-mentioned effects.

Thus, claims 1 and 2 reciting the highly pure hBN single crystals with features (A) and (B) would not be obvious from the disclosure of Bundy.

It is respectfully submitted that the claims as they have been amended are allowable over the art which has been applied in this Office Action.

One month extension of time is hereby requested. A credit card authorization form in the amount of $260.00 is attached herewith for the one month extension of time ($130.00) and request for correction of inventorship ($130.00).

Favorable reconsideration and allowance of this application are courteously solicited.

Respectfully Submitted,

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